No
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THE

DESCRIPTION

And USE of a

New Univerſal Dial,

OR,

Portable Equatorial Inſtrument,

By G. WRIGHT.

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THE
DESCRIPTION
AND
USE, of a new conſtructed
Octant, Sextant and Quintant.

By HIS MAJESTY's PATENT

Being an Improvement on the

HADLEY's QUADRANT,

By either of which, *Altitudes* are taken, and ANGULAR DISTANCES Meaſured to the greateſt *Preciſion* from 0'. to 160°. without a *Back Obſervation*, and with double the Space of *Illumination*, or Field of View: alſo a NEW METHOD of *Adjuſting* the *Glaſſes*, and applying the Inſtrument for the Purpoſes of Finding the LATITUDE and LONGITUDE at SEA.

By G. WRIGHT.

DESCRIPTION

AND USE OF A

New UNIVERSAL DIAL, &c.

THE copper plate figure annexed, ſo fully ſhews the conſtruction of the Dial at one view, that it would be uſeleſs to deſcribe the different parts, any further than to ſhew their connections with each other, in applying it to the various uſes it is intended for.

The firſt and moſt material thing to be obſerved is, that the inſtrument be properly and well adjuſted for obſerving with, which is done in the manner following: The parts being carefully taken out of the box in which it is packed, and placed on any firm table, or horizontal plane, properly ſituated to make your obſervations, you then adjuſt the Horizontal Plates, A a, by the milled ſcrews, B B B B,* until the Air Bubbles in the Glaſs Tubes become central, the uppermoſt plate, A muſt be turned quite round on its center, and the Bubbles ſtill remain in their places; during this revolution, ſhould they want adjuſting, there is ſmall ſcrews at the end of each tube for the purpoſe: The plates A a being thus made perfectly horizontal, put the Latitude Arch, or Meridian C into its place between the cheeks D, on the inſide of which there is a circular piece to fit into the grove on the back of the Latitude arch, C; this prevents it from getting out of its place; when you looſen the cheeks to elevate or

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* Some are made with 3 and ſome with 4 Screws, as may be thought moſt proper.

epreſs

depreſs the Meridian, on the front of the cheek D, is the Vernier, or Nonius Diviſion, which correſponds with thoſe of the Latitude Arch, and from thoſe diviſions you adjuſt it, and read off your latitude, to one, two, or five minutes according to the minutneſs of the dividing, but before this is done, you ſet the Pole in a vertical poſition, by making the 90 D on the Latitude Arch, coincide with the O of the nonius, there make it faſt by the ſcrew at the back of the cheeks D, and hang on the ſilken Plomb Line F to the ſmall S hook at G, and when at reſt, ſee that it makes a perfect coincidence with the line at the bottom of the arch H, the while you turn the top plate round its center, as before directed in adjuſting the Bubbles.

The Screws for perfecting this adjuſtment are 4, 2 of which paſs through the Baſe I into the top plate A, and if it is required to move them, care muſt be taken that you always tighten the oppoſite ſcrew to that you looſen ſo as to leave them firm. The other two Screws faſten the Nonius Piece D, and by looſening them, the nonius is ſhifted to the right or left of the 90 D on the arch at pleaſure.

The Dial being properly adjuſted, and the Plomb Line taken away, it may be applied to the following uſes.

Firſt, to find the Latitude of any place:——Bring the Latitude and Hour Circles together, and make, them faſt by putting the braſs pin into the hole at K, ſlide the Nonius Piece L, on the Hour Circle to the Suns's Declination for the given day, and about 20 minutes or ¼ of an hour before noon, obſerve the ſun's ſhadow, or ſpot which paſſes through the center of the Axis O, and gently move the Latitude Arch from its vertical poſition, till you obſerve the ſhadow or ſpot fall on the Croſs Line on the center of the Nonius Piece L, and ſo long as you obſerve the ſun increaſe in Altitude, you muſt depreſs the Latitude Arch, but when it appears to be ſtationary, and the ſhadow will fall no lower, faſten the ſcrew at the back of the cheeks D, and

the

the degrees cut by the nonius on the Arch, is the latitude of the place: to be ſtill more exact, you make allowance for the refraction of the atmoſphere, according to the ſun's altitude from the table, page 7.

The Latitude of the place being known; to find Time, by the Sun and Stars with the Dial: ——— From the Nautical, or any other Ephemeris, or book that hath a correct table of the ſun's declination, you take out the degree and minute for that day. If North, ſet the Nonius Piece L towards that part of the Hour Circle marked N D, if South, on the contrary ſide S D.——Obſerve likewiſe that the Meridian Arch is ſet to the latitude of the place, and put the Magnifying Glaſs in the braſs tube on it's place, at the Pole M, and by looking through it you may correctly ſet the Nonius Index of the Dial plate to the upper XII at S, take the braſs pin from the hole in the meridian at K, and looſen the Horizontal Screw N, and according as it may be morning or afternoon, with your hand gently move either to the right or left the innermoſt or Hour Circle, at the ſame time that you move the Horizontal Plate A, on it's center to the right or left alſo, till the Latitude Circle comes into the Meridian, and the ſhadow of the ſun will fall central on the Nonius Piece L, then read the time off, by the Nonius on the Dial Plate; the Horizontal Line on the inſide of the Nonius Piece L being a parallel of declination or path the ſun's ſhadow makes each day, it therefore cannot fall on the center of that line, at any time but when the Latitude Arch is truly in the meridian, or due North and South and therefore the Hour Circle moving round with the Poles, muſt give true time on the Dial Plate there is alſo a hole to the right, and croſs hairs to the left of the center hole, in the middle of the Axis O, where the ſun's ſhadow paſſing through, will alſo appear to the right and left of the center or croſs lines on the Nonius Piece L on the Declination Circle, thoſe holes are occaſionally uſed as ſight

ſight vanes to obſerve through, if the ſun is too weak to caſt a ſhadow, a dyed glaſs is put within ſide, to ſcreen the eye if required.

The beſt time to find a true meridian, is three or four hours before or after noon—and to take the difference of the ſun's declination from noon at the time you obſerve, if it be the morning, the difference is that and the preceding day, if afternoon, the difference of that and the following day, and a meridian being once found exact, bring the hour circle into the meridian, and having a fixed place for the Dial, and an object fixed alſo at a diſtance, direct the ſight at all times till the croſs hairs cut that object again, and the Dial will then be in the meridian for obſerving any of the planets, moon, or bright ſtars by night.

To find the ſun's Azimuth, by the Dial:——The Latitude Arch being in the meridian, bring the Pole into the Zenith, and faſten the Hour Circle in the meridian alſo by the pin at K, let the Horizontal Plates be likewiſe made faſt by the ſcrew N, and put the Index of the Dial Plate to XII o'clock, which is the South point, now take out the pin K, gently move the inner circle, (the outſide one remaining fixed) till the ſun's ſhadow, which paſſes through the central holes in the Axis falls on the center lines of the Hour Circle, and then read off the Azimuth from the Dial Plate, by looking through the Magnifying Glaſs, and by ſliding the Nonius Piece L, that the ſhadow falls on the croſs line, the altitude is taken at the ſame time with the azimuth, provided it be not more than 40 or 45 degrees.

Your watch having been ſet by the Dial, you ſtate the time by it that you take the azimuth.

Alſo with this poſition of the inſtrument and the Nonius Piece L being brought to the equatorial or center diviſion, it is fitted for levelling, and by depreſſing the Nonius Piece, you take equal altitudes, and all angular diſtances with their

their elevation and depreſſions from an horizontal line, by moving the Nonius Piece, above or below the equatorial plane.

Note, If the Horizontal Plate *a* is devided into 360° and a Nonius added to the Upper Plate A in the manner that the horizontal limb of a Theodolite is devided and alſo a Teleſcope fitted on to the latitude arch, to make it a vertical arch, and then put on a Triangular Staff with Paralel Plates, it makes a moſt compleate and portable Theodolite, for ſurvying, &c. &c. It may be alſo uſed for many other purpoſes in *practical aſtronomy, where a teleſcope is not required.*

A TABLE *of* REFRACTIONS *to be ſubtracted from the Apparent Altitudes, and added to the Zenith Diſtances.*

Alt	Refract.		Alt	Refract.		Alt	Refract.		Alt	Refract.		Alt	Refract.	
d.	min.	ſec.	d.	min.	ſec.	d.	min.	ſec.	d.	min.	ſec.	d.	min.	ſec.
½	27													
1	24	29	19	2	44	37	1	16	55	0	40	73	0	17
2	18	35	20	2	35	38	1	13	56	0	38	74	0	16
3	14	36	21	2	27	39	1	10	57	0	37	75	0	15
4	11	51	22	2	20	40	1	8	58	0	35	76	0	14
5	9	54	23	2	14	41	1	5	59	0	34	77	0	13
6	8	28	24	2	7	42	1	3	60	0	33	78	0	12
7	7	20	25	2	2	43	1	1	61	0	32	79	0	11
8	6	29	26	1	56	44	0	59	62	0	30	80	0	10
9	5	48	27	1	51	45	0	57	63	0	29	81	0	9
10	5	15	28	1	47	46	0	55	64	0	28	82	0	8
11	4	47	29	1	42	47	0	53	65	0	26	83	0	7
12	4	23	30	1	38	48	0	51	66	0	25	84	0	6
13	4	3	31	1	35	49	0	49	67	0	24	85	0	5
14	3	45	32	1	31	50	0	48	68	0	23	86	0	4
15	3	30	33	1	28	51	0	46	69	0	22	87	0	3
16	3	17	34	1	24	52	0	44	70	0	21	88	0	2
17	3	4	35	1	21	53	0	43	71	0	19	89	0	1
18	2	54	36	1	18	54	0	41	72	0	18	90	0	0

A TABLE

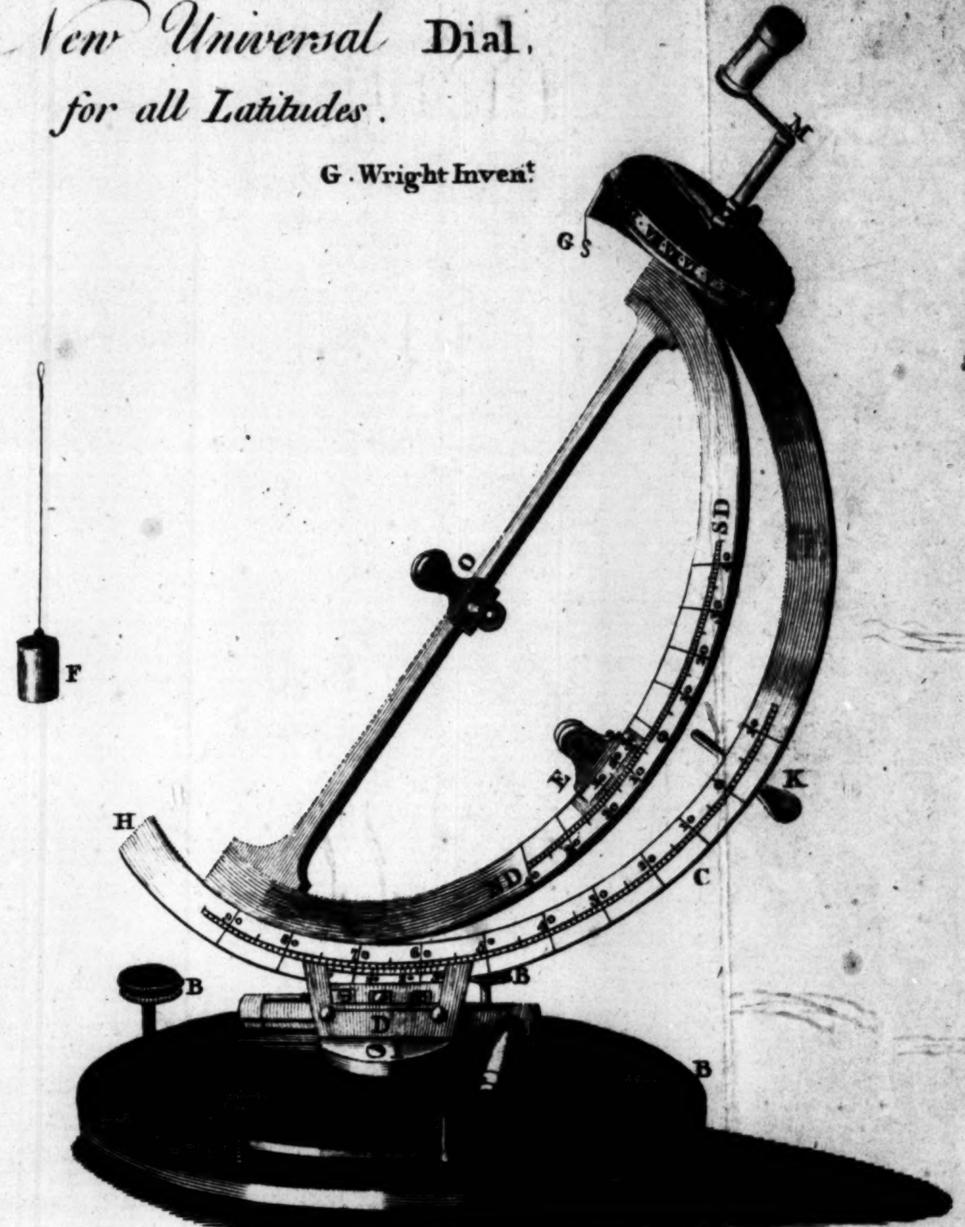
A TABLE *of the Equation of Time.*

Days	Jan. Add.	Feb. Add.	March Add.	April Add.	May Sub	June Sub	July Add.	Aug. Add.	Sept. Sub.	Oct. Sub.	Nov. Sub.	Dec. Sub.
	m. ſ.	m. ſ.	m. ſ.	m. ſ.	m. ſ.	m. ſ.	m. ſ.	m. ſ.	m. ſ.	m. ſ.	m. ſ.	m. ſ.
1	4 14	14 6	12 37	3 51	3 10	2 37	3 20	5 51	0 19	10 27	16 14	10 29
2	4 42	14 13	12 24	3 33	3 17	2 28	3 31	5 48	0 38	10 45	16 14	10 6
3	5 10	14 20	12 11	3 15	3 24	2 19	3 42	5 43	0 57	11 4	16 14	9 41
4	5 37	14 25	11 57	2 57	3 30	2 9	3 53	5 38	1 16	11 22	16 12	9 17
5	6 4	14 29	11 43	2 39	3 36	1 58	4 4	5 32	1 36	11 39	16 10	8 52
6	6 31	14 33	11 29	2 21	3 41	1 48	4 14	5 26	1 5	11 56	16 7	8 26
7	6 57	14 36	11 14	2 4	3 45	1 37	4 24	5 20	2 15	12 13	16 4	7 59
8	7 22	14 38	10 59	1 47	3 49	1 26	4 33	5 12	2 35	12 30	15 59	7 33
9	7 47	14 40	10 44	1 30	3 52	1 14	4 43	5 4	2 56	12 46	15 54	7 6
10	8 11	14 40	10 28	1 13	3 55	1 2	4 51	4 56	3 16	13 1	15 47	6 38
11	8 35	14 40	10 11	0 57	3 57	0 50	5 0	4 47	3 37	13 16	15 40	6 10
12	8 58	14 39	9 55	0 41	3 59	0 38	5 8	4 37	3 57	13 31	15 32	5 42
13	9 21	14 38	9 38	0 25	4 0	0 25	5 15	4 27	4 18	13 45	15 24	5 13
14	9 43	14 35	9 21	0 10	4 0	0 13	5 22	4 16	4 39	13 58	15 14	4 44
15	10 4	14 32	9 4	Sub. 4	4 0	0 0	5 28	4 5	5 0	14 11	15 4	4 15
16	10 25	14 28	8 47	0 19	3 59	Ad 12	5 34	3 53	5 21	14 24	14 52	3 46
17	10 44	14 24	8 29	0 33	3 58	0 25	5 40	3 41	5 42	14 36	14 40	3 17
18	11 3	14 18	8 11	0 47	3 56	0 38	5 45	3 28	6 3	14 47	14 28	2 47
19	11 22	14 12	7 53	1 1	3 54	0 51	5 49	3 14	6 24	14 58	14 14	2 17
20	11 39	14 5	7 35	1 14	3 51	1 3	5 53	3 0	6 45	15 8	13 59	1 47
21	11 56	13 58	7 17	1 27	3 47	1 16	5 56	2 46	7 6	15 18	13 44	1 17
22	12 12	13 50	6 58	1 40	3 43	1 29	5 58	2 31	7 27	15 26	13 28	0 47
23	12 27	13 41	6 40	1 52	3 39	1 42	6 0	2 16	7 48	15 34	13 11	0 17
24	12 42	13 32	6 21	2 3	3 34	1 55	6 2	2 0	8 9	15 42	13 54	Ad. 12
25	12 55	13 22	6 2	2 14	3 29	2 7	6 2	1 44	8 29	15 48	12 35	0 42
26	13 8	13 11	5 43	2 24	3 23	2 20	6 2	1 27	8 49	15 54	12 16	1 12
27	13 20	13 0	5 25	2 34	3 16	2 32	6 2	1 10	9 9	16 0	11 56	1 41
28	13 31	12 49	5 6	2 44	3 9	2 44	6 1	0 53	9 29	16 4	11 35	2 11
29	13 41		4 47	2 53	3 2	2 56	6 0	0 35	9 49	16 8	11 14	2 40
30	13 50		4 28	3 2	2 54	3 8	5 58	0 17	10 8	16 11	10 52	3 9
31	13 59		4 10		2 46		5 55	Sub. 0		16 13		3 38

In the above table, you have the number of minutes and ſeconds (for every day throughout the year) to be added to or ſubtracted from Solar Time, to ſhew Equated, or Mean Time, which is that always ſhewn by a good clock or watch.

A New Universal Dial, for all Latitudes.

G. Wright Invent.



Jno. Lodge sculp.